


Claims

1. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability such that a 1%w/v aqueous suspension of the starch has an absorbance at 700nm wavelength of less than 1.2 units following 4 freeze/thaw cycles of freezing at -70°C overnight and thawing at room temperature for at least 2 hours.

2. Potato starch according to claim 1, wherein 1%w/v aqueous suspension of the starch has an absorbance at 700nm wavelength of less than 1.0 units following 4 freeze/thaw cycles.

3. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability such that a 1%w/v aqueous suspension of the starch has an absorbance at 700nm wavelength of less than 0.9 units following 3 freeze/thaw cycles of freezing at -70°C overnight and thawing at room temperature for at least two hours.

4. Potato starch according to claim 3, wherein a 1% w/v aqueous suspension of the starch has an absorbance at 700nm wavelength of less than 0.7 units following 3 freeze/thaw cycles.

5. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability such that a 1%w/v aqueous suspension of the starch has an absorbance at 700nm wavelength of less than 0.7 units following 2 freeze/thaw cycles of freezing at -70°C overnight and thawing at room temperature for at least two hours.

6. Potato starch according to claim 5, wherein a 1% w/v aqueous suspension of the starch has an absorbance at 700nm wavelength of less than 0.5 units following 2 freeze/thaw cycles.

7. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability such that a 1%w/v aqueous suspension of the starch has an absorbance at 700nm wavelength of less than 0.5 units following 1 freeze/thaw cycle of

freezing at -70°C overnight and thawing at room temperature for at least 2 hours.

a 8. Potato starch according to claim 7, wherein a 1% w/v aqueous suspension of the starch has an absorbance at 700nm wavelength of less than 0.3 units following 1 freeze/thaw cycle.

9. Starch in accordance with claim 1 or 2, being further in accordance with claim 3 or 4.

10. Starch in accordance with claim 9, being further in accordance with claim 5 or 6.

11. Starch in accordance with claim 10, being further in accordance with claim 7 or 8.

sub 12. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability, such that a 5% w/v aqueous paste of the starch exhibits less than 40% syneresis following 4 freeze/thaw cycles of freezing at -70°C overnight and thawing at 22°C for 60 minutes, and then spinning at 8,000g for 10 minutes at 18°C .

13. Potato starch according to claim 12, which exhibits less than 30% syneresis following 4 freeze/thaw cycles.

14. Potato starch according to claim 12, which exhibits less than 20% syneresis following 4 freeze/thaw cycles.

15. Potato starch according to claim 12, which exhibits less than 10% syneresis following 4 freeze/thaw cycles.

16. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability, such that a 5% w/v aqueous paste of the starch exhibits less than 30% syneresis following 3 freeze/thaw cycles of freezing at -70°C overnight and thawing at 22°C for 60 minutes, and then spinning at 8,000g for 10 minutes at 18°C .

17. Potato starch according to claim 16, which exhibits less than 20% syneresis following 3 freeze/thaw cycles.
18. Potato starch according to claim 16, which exhibits less than 10% syneresis following 3 freeze/thaw cycles.
19. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability, such that a 5% w/v aqueous paste of the starch exhibits less than 30% syneresis following 2 freeze/thaw cycles of freezing at -70°C overnight and thawing at 22°C for 60 minutes, and then spinning at 8,000g for 10 minutes at 18°C .
20. Potato starch according to claim 19, which exhibits less than 20% syneresis following 2 freeze/thaw cycles.
21. Potato starch according to claim 19, which exhibits less than 10% syneresis following 2 freeze/thaw cycles.
22. Potato starch according to claim 12 and being further in accordance with claim 16 and claim 19.
23. Potato starch according to claim 13, and being further in accordance with claim 17 and claim 20.
24. Potato starch in accordance with claim 14, and being further in accordance with claim 18 and claim 21.
25. Potato starch in accordance with claims 15, 18 and 21.
26. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability, such that a 5% w/v aqueous paste of the starch exhibits less than 40% syneresis following 4 freeze/thaw cycles of freezing at -70°C for 1 hour and thawing at 22°C for 10 minutes, and then spinning at 8,000g for 10 minutes at 18°C .

27. Potato starch according to claim 26, which exhibits less than 30% syneresis following 4 freeze/thaw cycles.
28. Potato starch according to claim 26, which exhibits less than 20% syneresis following 4 freeze/thaw cycles.
29. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability, such that a 5% w/v aqueous paste of the starch exhibits less than 40% syneresis following 3 freeze/thaw cycles of freezing at -70°C for 1 hour and thawing at 22°C for 10 minutes, and then spinning at 8,000g for 10 minutes at 18°C .
30. Potato starch according to claim 29, which exhibits less than 30% syneresis following 3 freeze/thaw cycles.
31. Potato starch according to claim 29, which exhibits less than 20% syneresis following 3 freeze/thaw cycles.
32. Potato starch according to claim 29, which exhibits less than 10% syneresis following 3 freeze/thaw cycles.
33. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability, such that a 5% w/v aqueous paste of the starch exhibits less than 30% syneresis following 2 freeze/thaw cycles of freezing at -70°C for 1 hour and thawing at 22°C for 10 minutes, and then spinning at 8,000g for 10 minutes at 18°C .
34. Potato starch according to claim 33, which exhibits less than 20% syneresis following 2 freeze/thaw cycles.
35. Potato starch according to claim 33, which exhibits less than 10% syneresis following 2 freeze/thaw cycles.
36. Potato starch according to claim 26, being further in accordance with claim 30 and

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claim 34:

37. Potato starch according to claim 27, being further in accordance with claim 31 and claim 35.

38. Potato starch according to any one of claims 1-11, and being further in accordance with any one of claims 12-25 or any one of claims 26-37.

39. Potato starch according to any one of claims 1-11, and being further in accordance with any one of claims 12-25 and any one of claims 26-37.

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40. Potato starch which, when in native form extracted from a potato plant, has an apparent amylose content of less than 8% as determined by the method of Morrison & Laignelet (1983 Cereal Science 1, 9-20) and a ratio of fraction I to fraction II short chain glucans of at least 60%.

41. Potato starch according to claim 40, having a fraction I to fraction II ratio of at least 65%.

42. Potato starch according to claim 40, having a fraction I to fraction II ratio of at least 70%.

43. Potato starch according to any one of claims 40-42, being further in accordance with claim 38 or 39.

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44. Potato starch which, when in native form extracted from a potato plant, has an apparent amylose content of less than 8%, as determined by the method of Morrison & Laignelet (1983 Cereal Science 1, 9-20), and a viscosity onset temperature of less than 67°C as determined by viscometric analysis of a 7.4% (w/v) aqueous suspension of the starch using a Rapid Visco Amylograph, Newport Scientific Series 4 instrument operating on the standard 1 heating and stirring protocol.

45. Starch according to claim 44, having a viscosity onset temperature of less than 65°C.

46. Starch according to claim 44, having a viscosity onset temperature of less than 55°C.

47. Starch according to claim 44, having a viscosity onset temperature of less than 51°C.

48. Starch according to any one of claims 44-47, being further in accordance with any one of claims 1-43.

49. Potato starch which, when in native form extracted from a potato plant, has an apparent amylose content of less than 8% as determined by the method of Morrison & Laignelet (1983) and, when analysed by differential scanning calorimetry using a Perkin Elmer DSC7 instrument a 10mg starch sample in aqueous mix of less than 25% starch w/v exhibits a gelatinisation onset temperature of less than 67°C.

50. Potato starch according to claim 49, which exhibits a gelatinisation onset temperature of less than 66°C.

51. Potato starch according to claim 49, which exhibits a gelatinisation onset temperature of less than 51°C.

52. Potato starch according to claim 49, which exhibits a gelatinisation onset temperature of less than 50°C.

53. Potato starch according to any one of claims 49-52, and being further in accordance with any one of claims 1-48.

54. Starch according to any one of the preceding claims, wherein the starch granules are substantially free of cracks.

55. A plant cell comprising introduced nucleic acid sequences, which sequences specifically inhibit the expression of granule bound starch synthase I (GBSSI) and at least

~~one further starch synthase enzyme involved in starch synthesis in the plant cell.~~

56. A plant cell according to claim 55, wherein the said ~~at least one further starch synthase enzyme specifically inhibited by the introduced nucleic acid sequences comprises starch synthase II and/or starch synthase III.~~

57. A plant cell comprising introduced nucleic acid sequences, which sequences specifically inhibit the expression of three or more enzymes involved in starch synthesis in the cell.

58. A plant cell according to any one of claims 55-57 which synthesises freeze/thaw stable starch as a result of the introduction of the nucleic acid sequences.

59. A potato plant cell according to any one of claims 55-58.

60. A plant comprising introduced nucleic acid sequences, or the progeny of such a plant, wherein the introduced nucleic acid sequences specifically inhibit the expression of GBSSI and at least one further starch synthase enzyme involved in starch synthesis in the plant.

61. A plant according to claim 60, in which the introduced nucleic acid sequences specifically inhibit GBSSI, and one or both of SSII and SSIII.

62. A plant according to claim 60 or 61, produced from a plant cell according to any one of claims 55-59.

63. A potato plant according to any one of claims 60-62.

64. A potato plant according to claim 63, which gives rise to starch according to any one of claims 1-54.

65. A method of altering the starch content of a plant, the method comprising the steps of; providing nucleic acid sequences, and introducing said sequences into the plant,

wherein the sequences specifically inhibit the expression of GBSSI and at least one further enzyme involved in starch synthesis in the plant.

66. A method according to claim 65, wherein the sequences are introduced into a plant cell, and the plant cell is grown into a plantlet and subsequently into a plant.

67. A method according to claim 65 or 66, wherein the sequences are introduced into a potato plant or plant cell.

68. A method according to any one of claims 65, 66 or 67, wherein the introduced sequences specifically inhibit the expression of GBSSI and one or both of SSII and SSIII.

69. A method according to any one of claims 65-68, wherein the introduced nucleic acid sequences are operably linked in the antisense orientation to a promoter active in the plant, so as to cause transcription of the sequences.

70. A plant produced by the method of any one of claims 65-69.

71. Starch obtained from a plant altered by the method of any one of claims 65-69.

72. A method of making starch, the method comprising the steps of: altering the starch content of a plant by the method of any one of claims 65-69; and extracting the altered starch content from the plant.

73. A method according to claim 72, further comprising the step of modifying the extracted starch by physical, and/or enzymatic and/or chemical processing *in vitro*.

74. Potato starch which, when in native form extracted from a potato plant, exhibits freeze-thaw stability.

75. Use of starch according to any one of claims 1-54 or claim 74 in the preparation of: thickener compositions; packaging; adhesives; paper; coatings; or personal care products.

76. Potato starch substantially as hereinbefore described and with reference to the accompanying drawings.

77. A plant cell substantially as hereinbefore described.

78. A plant substantially as hereinbefore described.

79. A method of altering the starch content of a plant substantially as hereinbefore described.

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